Remarks

The Examiner has indicated that claims 5 – 7 and 17 – 19 are objected to as depending upon rejected claims. Accordingly, claims 5, 6, 17, and 18 have been rewritten in independent form, incorporating all of the limitations of the claims from which they previously depended. Claim 7 depends from claim 6, and claim 19 depends from claim 18. Accordingly, it is submitted that claims 5 – 7 and 17 – 19 are now allowable, and not subject to objection.

Claims 1 – 4, 8 – 16, and 20 – 22 stand rejected under 35 U.S.C. §103(a) as unpatentable over Ake U.S. Pat. No. 4,907,874. The Examiner asserts that Ake discloses a device capable of detecting and displaying the relative position of a generally horizontal reference plane of light comprising a vertically oriented row "wherein photodetector elements provide electrical output when illuminated with a plane of light, an output circuit for determining the relative levels of reference signals, a weighting circuit for providing electrical output of photodetector elements and a display for providing an indication of position of the reference plane of light with respect to the detector device. Although Ake does not claim an additional row of photodetector elements, he teaches that shading the elements by the edge of the case can be corrected by realignment or rearrangement of photodetectors in the device." The Examiner goes on to assert "It would have been obvious to one of ordinary skill in the art at the time of the invention to add an additional row of elements to improve detection, since Ake teaches that the realignment and rearrangement of photodetectors can be used to improve detection and eliminate problems caused by shading."

The Ake patent shows a detection arrangement that is very different from that of the present invention because it is intended to deal with problems that are very different from those that the present invention addresses. The Ake detection device addresses the problem of erroneous beam detection that can occur as a result of partial shading of a pair of triangular-shaped photodetector elements. As is apparent from Fig. 2 of the Ake patent, when the detection device is misaligned by rotation about its vertical axis, a portion of the photodetector elements may be shaded from the light 34 by the case 18 at the side of the aperture 16. This results in light being blocked from hatched area 36. It will be apparent that element 30 will provide a

higher level output signal in this situation than element 32, since a larger area of element 30 remains illuminated. As a consequence, the light 34 will be indicated as being higher on the elements 30 and 32 than is actually the case.

The solution to this problem provided by Ake is to reconfigure the two photodetector elements as interdigitated elements in the fashion shown in Fig. 3 of Ake. The two photodetector elements are provided as a series of thin strips that are interlaced, with the thicker strips of element 40 being at the bottom of the row and the thinner strips of element 40 being at the top of the row. Conversely, the thicker strips of element 38 are positioned at the top of the row and the thinner strips of element 38 are positioned at the bottom of the row. These strips are all sufficiently thin in relation to the thickness of the plane of light that is to be detected such that a number of these strips are illuminated by the light simultaneously. Note that the strips of element 38 are connected directly in parallel electrically. Similarly, the strips of element 40 are connected directly in parallel electrically. As a result, when the upper portion of the row is illuminated, the area of element 38 illuminated will be greater than the area of element 40 illuminated, and the output on line 23 will be greater than the output on line 24. When the lower portion of the row is illuminated, the area of element 40 illuminated will be greater than the area of element 38 illuminated, and the output on line 24 will be greater than the output on line 23. Any partial shading of the elements 38 and 40 in the manner shown in Fig. 2 will not affect the relative magnitudes of these two signals.

The present invention, on the other hand, relates to a type of receiver that is not susceptible to an erroneous reading resulting from partial shading. The present invention is therefore not designed to avoid this problem. Rather the present invention is intended to simplify the circuitry in a laser receiver. The receiver of the present invention incorporates a generally vertically aligned row of discrete photodetector elements in a configuration of the type that has been used in many laser receivers. Such devices have typically included separate circuitry for each photodetector element for processing the outputs from each of the elements. Naturally, using a large number of amplifiers and a significant amount of processing circuitry is not desirable for a number of reasons, including cost and complications in design. The present

invention simplifies the circuitry connected to a plurality of discrete, separate photodetector elements. Rather than using a separate circuit to detect illumination of each of the photodetector elements, the present invention contemplates providing two output signals on lines 23 and 24, shown in Fig. 2 of the present application, that indicate by their relative magnitudes the vertical position of the photodetector element or elements that are being illuminated.

To produce these signals on line 23 and line 24, the photodetector arrangement 14 further includes a weighting circuit 30. The weighting circuit 30 has resistors R1 – R4 and R6 – R13, inductors L1 and L2 (shunting D.C. sunlight current), and tapped transformer T1. Each of the plurality of photodetector elements CR2 – CR13 is connected to the transformer T1, either directly or through one or more of the resistors. The weighting circuit provides a portion of the electrical output of each photodetector element as a component of the first reference signal on line 23, related to the spacing of the photodetector element from the upper end of the row. The weighting circuit also provides a portion of the electrical output of each photodetector element as a component of the second reference signal on line 24, related to the spacing of the photodetector element from the lower end of the row. The weighting circuit 30 is configured such that the first reference signal on line 23 increases as the light moves toward the upper end of the row of PIN diodes, and the second reference signal on line 24 increases as the light moves toward the lower end of the row. Conversely, the first reference signal on line 23 decreases as the light moves toward the lower end of the row of PIN diodes CR2 – CR13, and the second reference signal on line 24 decreases as the light moves toward the upper end of the row. When the light is in the middle of the row, the levels of the two reference signals on lines 23 and 24 are equal. The output circuit 22 responds to relative levels of the first and second reference signals on lines 23 and 24 to determine the position of the reference plane of light.

The claims in the present application clearly define the invention over the Ake reference. Claim 1, for example, calls for "a weighting circuit for providing a portion of the electrical output of each photodetector element as a first reference signal related to the spacing of the photodetector element from a first end of said row, and for providing a portion of the electrical output of each photodetector element as a second reference signal related to the spacing of the

photodetector element from the second end of said row." The Ake reference simply does not show a "weighting circuit" that performs this function. In the Ake device, each of the sections of the first photodetector element 38 is directly connected to line 23, and each of the sections of the second photodetector element 40 is directly connected to line 24. There is no provision for a "weighting circuit," as claimed, in the Ake disclosure and no reason why the Ake receiver would be modified to include such a weighting circuit. The Examiner's sole suggestion as to why it would be obvious to modify the Ake receiver is the following: "It would have been obvious to one of ordinary skill in the art at the time of the invention to add an additional row of elements to improve detection, since Ake teaches that the realignment and rearrangement of phtodetectors can be used to improve detection and eliminate problems caused by shading." Applicant wishes to point out that the deficiency in the teaching of Ake is not that it does not include "an additional row of elements." Claim 1 does not call for "an additional row of elements." Rather the deficiency in Ake is that it does not disclose or suggest a weighting circuit that receives a the electrical output from each receiver and provides a portion of that output as a part of a first reference signal, and that output as a part of a second reference signal. The weighting circuit called for in claim 1 is not found in Ake, and there is nothing comparable to it in Ake. Further, there is absolutely no reason why a person of ordinary skill in the art would think to add a weighting circuit to the receiver of Ake.

Turning to claim 12, it will be noted that this claim recites the step of "providing a portion of the electrical output of each photodetector element as a first reference signal and providing a portion of the electrical output of each photodetector element as a second reference signal, the relative portions of the electrical output from each photodetector being related to the vertical position of the photodetector in the row." Nowhere in the Ake reference is there a teaching of such a step. In the Ake reference, the ALL of the output signal from a given portion of the photodetector element is applied to one of the lines 23 and 24, and makes up a part of the reference signal on that line. In the Ake reference there is no splitting of the output signals for each of the photodetector elements between the two lines 23 and 24, let alone splitting the output signal from a photodetector depending upon the relative position of the photodetector in the row. Further, there is nothing in the disclosure of Ake that would suggest such an arrangment.

Claims 2 – 4 and 8 – 11 depend either directly or ultimately from claim 1 and are patentable over Ake for the same reasons as presented above with respect to claim 1. Similarly, claims 13 – 16 and 20 – 22 depend either directly or ultimately from claim 12 and are patentable over Ake for the same reasons as presented above with respect to claim 12.

In conclusion, claims 5 – 7 and claims 17 – 19 have been rewritten to include all of the limitations of the claims from which they respectively formerly depended. In view of the Examiner's prior indication of allowable subject matter, it is submitted that these claims are now in condition for allowance. Additionally, it is respectfully submitted that all of the remaining claims in the present application are in condition for allowance in view of the further remarks submitted herewith.

Respectfully submitted,
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